MINING LIMESTONE BY UNDERGROUND INSTEAD OF OPEN QUARRY WORK.

BY E. B. WILLARD.

Mr. President and Gentlemen of the Ohio Institute of Mining Engineers:

Having been requested by your Secretary to prepare a paper to be read before this meeting, I consented to offer this on the subject of "Mining Limestone," as being the only subject on which I could hope to offer anything new or interesting to you.

Some six years since, having undertaken to supply some of the blast furnaces, located at Ironton, Ohio, with limestone from the land formerly owned by the New York and Ohio Iron and Steel Company in Elizabeth Township, Lawrence Co., O., great difficulty was experienced in keeping up a regular supply during the Winter and early Spring months. The supply of limestone for all furnaces in Lawrence County is obtained from the ferriferous limestone vein, which lies from 14 to 25 feet below No. 5 coal vein, and up to very recent times has been obtained entirely by stripping and open quarry working. In most places the covering immediately overlying the limestone is a soft No. 2 Fire or Potters Clay, from 4 to 10 feet thick. Just under the limestone lies another vein of clay and slate. Both veins of clay absorb a great deal of water, and in wet and after freezing weather, run like thin mortar. These circumstances together with the exposure necessarily incurred by the workmen during bad weather greatly increased the expense of procuring a supply of limestone, or else involved the necessity of piling up large quantities of limestone during good weather to be used during bad weather. Moreover the difficulty and expense of loading limestone out of piles in freezing weather added quite materially to the cost of the limestone, when delivered to the furnaces.

Upon looking over the territory from which the supply of limestone was to be obtained, quite a large district was noticed from which no limestone or ore had been taken by stripping. Inquiry developed the fact that this territory had not been worked for ore, because there was a covering of sandrock immediately over the limestone, which takes the place of the Pot-

ters Clay previously mentioned. This sandrock is quite hard, in fact so hard that it could not be stripped from the ore and limestone to permit the working of either.

It was suggested that underneath this rock, as a roof, the limestone and ore both could be mined on the "pillar and stall" system, just as coal is worked. Plenty of good men were to be had, who had mined ore and coal under all kinds of roof. But almost without exception they said it would not be possible to mine limestone cheaply enough to compete with the open quarry product. They would undertake the work only by the day, because they did not know what they could do by the yard or ton. After many delays and a frequent change of workmen, and many experiments to get the most suitable tools and equipment, sufficient entry was driven to turn six rooms. The difficulty arose of getting men to risk the experiment of mining by the ton, as day work was not to be thought of if it could be avoided. After a good many changes and failures on the part of the miners, a crew was found sufficient to work the six rooms. It seemed at first as if any good miner ought to be able to put out enough stone from a vein from five to eight feet thick to make good wages, or at least as good wages as those who were working in the ore could. But many new features had to be learned. For instance how and where to drill the holes, how much dynamite to charge and various other peculiarities, which were new, and which each different man had to work out for himself. Some men did not seem to be able to learn at all and gave up.

After a while the success of the experiment was demonstrated and men took hold without trouble. Now it is easier to get men to mine the limestone under cover than it is to get them to undertake open quarry work. They do not have to loose time on account of wet or freezing weather, they are not exposed to changes of temperature, as they avoid the heat of summer and the cold of winter and a great part of the mud and dirt of the potters clay in wet weather. As practiced now the mining is carried on pretty much the same as mining coal, except that generally three or four men work in each room. The miners furnish their own tools of all kinds and all of the ammunition, which consists entirely of dynamite of from forty to sixty per cent. strength, and loads the limestone into mine wagons ready to be hauled out by the drivers. All work is done by hand. It has been proposed to use machinery, but the only part of the work to which it is applicable is the drilling. Whether or not a sufficient saving could be effected in the drilling to compensate for the machinery and power is a matter of doubt. As the mining is now done, the limestone is delivered on cars at forty-five cents per gross ton,

and this can be done all the year around, avoiding the necessity of carrying large stocks at any time of the year.

It is found on following the limestone underground that the vein has a great many irregularities in thickness and dip, and sometimes runs out entirely. In fact the formation is much more irregular than the No. 5 coal which lies so closely above it.

MR. HARRY: Mr. President, he don't tell us in his paper, but they mine it in a coal mine at Hanging Rock. They first take up the bottom which is about 6 or 7 feet thick after the coal is taken off, then they strip this dirt off and mine the limestone away from underneath that and the rooms in a great many places there are as high as 14 feet from the roof to the bottom of the limestone. They first work out the coal above and then they shoot the dirt off and take the limestone out. They start at the mouth of the room and slope down so they can pull the cars up and drive it on as far as the room has been worked out.

MR. ROY: Is that where he speaks of.

MR. HARRY: I think it is. Now down at Willard and Brightons they mine the lime up in the hills, but I think the special point is the limestone they are taking out of the coal mine.

MR. ROY: Mr. President, I believe that mine would be well worth visiting when we take our next summer tour. Now there is something I don't quite understand from Mr. Willard's paper. I understood from his paper that the No. 5 coal is 6 to 14 feet above the limestone.

SECRETARY HASELTINE: I believe that is right, I will look at the paper again. From 14 to 25 feet below No. 5 coal.

MR. ROY: Yes. Well this matter is something that I have been thinking about a great deal. I have charge of 10,000 acres of land down there in which this limestone vein runs through the greater extent of the territory, except where the latter is cut up by roof and the underlying coal and the upper coal, that is No. 4 and No. 5 are both there, but it would be easier to get the limestone by working up No. 4 coal, the same I spoke of as being started last year at the Buckeye furnace. They shoot the lime-

stone down. Now above the limestone in all that Hanging Rock region is ferriferous ore, and it has been stripped all over the country until the whole Hanging Rock region is a series of terrace work, and when the miner could not strip any further he quit and there are millions of tons of ore in the inside of the hill that has never been touched. It is not red ore, oxidized ore that Prof. Lord speaks of, but the blue ore, and while it was not fitted for charcoal use it has been used for making iron by stone coal. Now the matter that has been bothering me is how to get that ore out. The ore runs out sometimes to nothing. There would be nothing in the way of mining it in connection with the coal if it was not for the thickness of the limestone, unless there was a market for the limestone. The ore itself would probably sell for $1.50 per ton. To go in the hill and take out ore on an average of 10 inches thick and take out enough dirt from above and below makes it very costly, and in that country there are no railroads yet, no railroad direct to the mine except down towards Ironton; and I would have been glad if Mr. Willard had been here to enlighten us upon this subject. That ore has got to be taken out of there some way, and we ought to try to find out a way to do it.

MR. HARRY: In some parts they go under this top strata between the coal and ore and prop poles up. A great many of the rooms they don't do that. They take it down. In some of the rooms they have strata enough above so they can prop it up, but in the majority of the rooms that I have seen they let it come clear down, especially over the roadway. It is very brittle clay, that is between the ore and coal. They have a good rock roof above that. Some of the places I believe on the south side of the mine where they get this fire clay they also use the fire clay there. They take it out at the same time. On the south side the strata above appears to be thicker than it is on the north side of the main entry, and they prop up the strata there between the coal and lime; but in most cases they allow it to come down, especially over the roadway. In most cases they take out the fire clay with the lime. They haul it right out through the tunnel and tip it at the same time as the coal. They haul it out by

trips, part of the trip will be limestone, and part of it fire clay, and part of it coal.

MR. ROY: It is true, the No. 5 coal comes down close to the limestone in many places.

THE CHAIR: I am sorry that Mr. Willard was not here so as to enlighten us a little more on this subject, because it is a very important one especially to the southern part of the State. It is a new thing to me. I never knew limestone to be mined underground. I am very sorry Mr. Willard is not here because it is a very important subject he has written upon, and it leaves us a little in the dark from the fact of Mr. Harry being acquainted with that part of the State too. but it seems to me by the paper that where he speaks of that they mine nothing but the limestone.

MR. ROY: It is a very common thing in that country for the limestone to go up and down.

THE CHAIR: Probably the best thing we can do with this paper now is to let it go and some one here will think of it in the summer meeting and bring it up for discussion if Mr. Willard is there. I think it will give us a great deal of light, not that it will practically amount to anything to me, but it is a new thing to me and I think the most of us. I never expected to hear of limestone being mined as iron ore and coal. I supposed it would cost too much. But if it can be mined at 45 cents on the car as he says, that is about as cheap as you can get it anywhere I guess.

A MEMBER: Mr. President, that is not altogether new. We have mined it in our neighborhood for more than ten years for furnace purposes.

THE CHAIR: That is in connection with the coal?

FORMER SPEAKER: No coal at all, pure and simple limestone. The vein is opened the same as coal, going with your entries and turn off your rooms in the same manner and haul it out the same as coal. All limestone mining that lies about as No. 8 coal has been abandoned for furnace purposes, but that

was mined with us ten years ago, and it is yet mined in a small way for lime.

MR. ROY: Do you know what it costs to get the ore there?

FORMER SPEAKER: No, I don't know now what it costs. It is some six or seven years since the furnace went on to Bessemer iron, but I suppose the cost is not greater than the ordinary stripping, but they wouldn't keep up the stripping and the stripping was abandoned, and the limestone mine was opened.

MR. ROY: How long do they make the rooms?

FORMER SPEAKER: About 8 or 10 feet.

MR. ROY: How do they mine? Do they blow up the bottom first?

FORMER SPEAKER: I don't know that I can give a description of the mine, as I was not connected with it any more than I passed by where they were mining and called in.

SECRETARY HASELTINE: I move you that Mr. Willard be tendered a vote of thanks for his very interesting paper. This is the first paper I ever knew to be presented before the Institute where the author was not present that elicited any discussion. We generally have been very modest about inquiring into the subject from a feeling of extreme modesty I presume. This seems to be an exception to the rule.

The motion being seconded, prevailed.

THE CHAIR: As we have passed Prof. Lord's paper we will have it next, and as the Professor wishes to put some figures on the board, we will now go on with the election of officers so as to expediate the business a little. The officers to be elected are President, Vice President, Secretary and Treasurer and an executive committee.

MR. ROY: Mr. President, if nominations are in order I move we elect by acclamation the present President and Secretary.

THE CHAIR: Gentlemen, I certainly appreciate that very much myself and thank you, but for the reason that I do not

expect that I will be with you at the next summer meeting I would like to have some one else elected President, because I think that a President ought to be in every meeting. It is probable, indeed it is likely, that I will not be able to be with you and hence while I appreciate the compliment, I would prefer to have some one else elected as President.

A MEMBER: I second Mr. Roy's motion.

MR. ROY: The President is perhaps a little too modest to put the motion and I will put it myself.

Mr. Roy put the question before the meeting and it is unanimously carried.

CAPT. MORRIS: I move that Prof. Lord be elected Vice President.

A MEMBER: I second the motion.

PROF. LORD: Gentlemen, I hope you will give this position to some one who has more age and experience in mining than I have. Therefore I would move the name of Mr. Roy as Vice President.

SECRETARY HASELTINE: If we are going to be deprived of the services of our tried President at the summer meeting we should have some one who is certain to attend, and it will be a great convenience in preparing for the summer meeting to have the head of the Institute located as near as possible in the center of the State. I think the nomination of Prof. Lord is a very good suggestion and I hope you will not attempt to decline.

The question being upon the motion of Capt. Morris it prevailed unanimously and Prof. Lord was elected Vice President.

THE CHAIR: The next on the programme is the election of the executive committee. There are three to be elected.

SECRETARY HASELTINE: I would name the Hon. Andrew Roy as one of the executive committee.

MR. ROY: Mr. President, as the executive committee has much to do and does nothing, feeling that it is a good thing to

have a soft snap, I would suggest that the old committee be re-elected. I believe I am one.

SECRETARY HASELTINE: Prof. Lord is one, Prof. Sperr and yourself were the executive committee last year, and I want to say that neither one of them showed up nor offered any suggestions. I want to thank them though, as they didn't throw any cold water on anything that was done. I would like to have an executive committee that would take some of the burdens of the executive committee on their shoulders.

MR. ROY: I would nominate my excellent friend, the poet.

THE CHAIR: Mr. Roy, Prof. Sperr and Mr. Morris have been nominated.

A MEMBER: Hasn't Mr. Morris got another office here, poet laureate.

THE CHAIR: That is honorary. It is something like the relation of Tennyson to the Queen.

A MEMBER: I move the nominations close and that the three gentlemen named be elected as executive committee.

The motion being seconded, prevailed.

SECRETARY HASELTINE: Mr. President, as Prof. Lord is not quite ready let us dispose of a little of our miscellaneous business, and among the most important business is the summer meeting and how it shall be conducted, and as the officers of the Institute except Prof. Sperr are all here, it seems to me that it is a most appropriate time to discuss that matter. Probably we can never get them together another time before the summer meeting. I would like to have suggestions from members of the Institute or from anybody as to what the summer meeting shall consist of and where it shall be held, and advanced ideas anybody may have on the subject. Last summer's meeting, while as Mr. Roy suggested about his paper, it was foreign to the State. The conduct of it is foreign to our constitution and by-laws and was conducted regardless of our rules, still I think every one was satisfied with it, and whether we want to continue that summer meeting or not I would like to hear from you.

MR. ROY: There is a new coal field being opened up in West Virginia on the Twelve Pole River. I have got to be pretty familiar with that, being there over a year, and I can assure you now that if you wish to go over there and see some magnificent scenery and be handsomely treated you can do so, and you will have a train put at your disposal with this condition—that the road may not be finished up at the tunnel. The road will be finished up to the tunnel at Twelve Pole. I speak advisedly about this matter because I have written to one of the general managers of the Guyandot Coal Association, who own over 200,000 acres there and they want us to go; that is to say, if we go, they will treat us as we were treated last summer, if not better.

SECRETARY HASELTINE: At Mr. Roy's suggestion on this same enterprise, I spoke to the general manager of the Norfolk & Western Road here at Columbus in a casual way about it one day, and he grabbed at the idea at once. He said they would take the matter up at once, and he was certain they would gladly extend us all the courtesies of their road from Columbus as far in the State of West Virginia as their road would be completed. I confess I have not looked up the geography of that country as closely as I would like, and if there is any one here who is familiar with it, I would be glad to have them enlighten us. It struck me it would be a capital move for the Institute if possible to go down on this excursion and examine this coal field.

MR. ROY: We could not go on the Norfolk & Western; we would have to go on the Chesapeake & Ohio.

THE CHAIR: I would say for myself that I think it is a very good suggestion of Mr. Roy's, and I see the Secretary falls in with it. I think it would be profitable. It is a new country, a new mining Company, and I have no doubt we would see many interesting things there. How long will it take us to go there from here?

MR. ROY: It is about 200 miles from here.

THE CHAIR: Then we could go in a day.

MR. ROY: Nicely.

THE CHAIR: I certainly am in favor of it, and I think since the matter has gone as far as it has that the executive committee should make arrangements to go to West Virginia.

MR. ROY: I was going to suggest that we ought to enlarge our constitution and take in these tracts. We have been in every coal region in the State of Ohio now, and like Alexander we will have to find new worlds to conquer. I think it would be well enough to amend the constitution so that we can take in members from other States, and make it more a National Society than a State Society, and get members from all the States. I have no doubt that men would be glad to come and see us every year and give us the result of their systems of mining and get new ideas from other States. We saw a great many things in the Kanawha Valley last year that we didn't know. We get new ideas from people in different States. Some of them would come from as far as Alabama perhaps if we would enlarge the constitution, and make it so that coal miners from any State in the Union could get in.

SECRETARY HASELTINE: I would be loath to give up the name. If we enlarge it and make it a national Institute, I would still want to retain the old name that we have fought so many adversed battles under. With this in view, I move you, Mr. President, that you appoint a committee of three, of which Mr. Roy shall be the Chairman, to revise our Constitution in accordance with our advanced mode of thinking.

THE CHAIR: Why would not the executive committee already appointed be a good committee for that? Wouldn't they fill the bill equally as well as any committee that you could possibly get? That committee is Mr. Roy, Prof. Sperr and Capt. Morris. Now I don't know that I could improve on that committee, but if you think I can why of course I will entertain the motion, but it strikes me that the executive committee would be the parties to look the matter over.

SECRETARY HASELTINE: I have no objection to that committee. I don't want any personal feeling about it. Here is Mr. Wileman, who has been giving this matter a great deal of thought

in connection with the Ohio Society of Civil Engineers and Surveyors. He is quite an advanced thinker on that subject. I think he would make a very valuable thinker on that committee in some capacity.

THE CHAIR: I wish some one would name this committee. Perhaps there are some members here that I am not so well acquainted with. Two have been named, Mr. Roy, Mr. Wileman and who else shall we appoint on this committee.

MR. ROY: Prof. Lord.

THE CHAIR: Prof. Lord, Mr. Roy and Mr. Wileman are named as this committee to revise the Constitution and report here to-night if possible.

The question then coming on the motion of Secretary Haseltine to appoint a committee it was carried.

SECRETARY HASELTINE: I have in my hands, Mr. President, the petition of a number of gentlemen for membership.

The Secretary here read the list of names.

MR. CHALKLEY DAWSON: I was one of the charter members of this association, but for various reasons I have allowed my membership to lapse and I would ask that my name be added to the list.

A MEMBER: Mr. President, I move the rules be suspended and the Secretary be instructed to cast the ballot of the association for these gentlemen for membership.

The motion being seconded prevailed.

THE CHAIR: We will now have Prof. Lord's paper.